Homework 1

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excersize 1)
we know that

$$x_1 = 2 \qquad x_2 = 3 \qquad \frac{\delta L}{\delta o} = 5$$

$$o = x_1 * x_2$$

To find $\frac{\delta L}{\delta x_1}$ and $\frac{\delta L}{\delta x_2}$ we use the Chain rule which gives us $\frac{\delta L}{\delta o}\frac{\delta o}{\delta x_1}$ and $\frac{\delta L}{\delta o}\frac{\delta o}{\delta x_2}$ respectively. It can be derived that $\frac{\delta o}{\delta x_1}$ and $\frac{\delta o}{\delta x_2}$ are x_2 and x_1 respectively
Therefore we can solve for both

$$\begin{aligned}\frac{\delta L}{\delta x_1} &= \frac{\delta L}{\delta o}\frac{\delta o}{\delta x_1} \\ &= 5 * x_2 \\ &= 5 * 3 \\ \frac{\delta L}{\delta x_1} &= 15\end{aligned} \qquad \begin{aligned}\frac{\delta L}{\delta x_2} &= \frac{\delta L}{\delta o}\frac{\delta o}{\delta x_2} \\ &= 5 * x_1 \\ &= 5 * 2 \\ \frac{\delta L}{\delta x_2} &= 10\end{aligned}$$

excersize 2)
We know that $\vec{w_1} = 0.1$, $w_2 = 0.5$, $w_3 = 0.4$, $w_4 = 0.3$, $w_5 = 0.2$, $w_6 = 0.6$. The Hidden Layer and Actrivation Layer both have the activation function as $y_n(z) = \frac{1}{1+e^{-1}}$. The Loss function is $L = \frac{1}{2}(y - \hat{y})^2$.
Our starting point is $\begin{pmatrix} \begin{pmatrix} 0.82 \\ 0.23 \end{pmatrix} & 0 \end{pmatrix}$

$$\begin{aligned} 2x - 5y &= 8 \\ 3x + 9y &= -12 \end{aligned}$$